

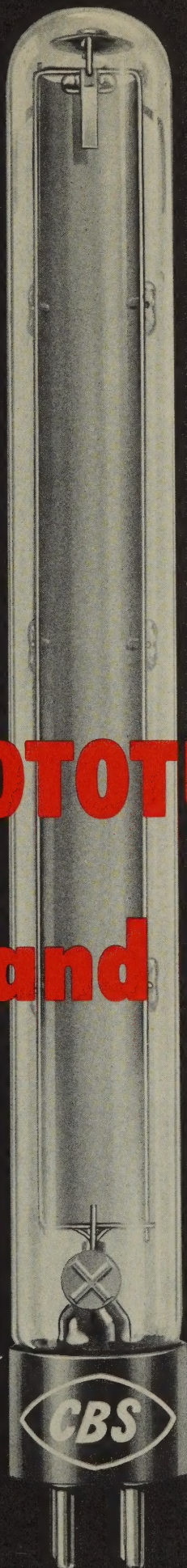
VACUUM PHOTOTUBES

GAS PHOTOTUBES

PHOTOCELLS

THE JOHN A. BECKER CO.
14 BROWN STREET
DAYTON 2, OHIO BA 4-1071

PHOTOTUBES and PHOTOCELLS





PHOTOTUBES

(CBS Photocells are described elsewhere in this bulletin)

CBS phototubes are available in many different types, both gas-filled and vacuum. The principal difference between types, except for spectral response differences, is in the size and shape of the anode and cathode. The sensitivity of one cathode is about the same as another particularly where a spot of light does not utilize the entire cathode. Where the entire cathode is utilized, then the output of a larger cathode will be greater than the smaller cathode.

Choice of tube size depends almost entirely on mechanical limitations. Type CE-25 is ideal for small spaces and types CE-1 or CE-2 for larger spaces. Also, the angle from which the light is to approach should be considered. If it is desirable to have the light approach toward the end of the glass envelope type CE-22 is suitable.

The anode shape may be rectangular, straight wire, or "U" shaped. It is generally determined by the need to avoid shadow effects on the cathode. There is an advantage in having shadowless cathodes for certain uses for which special tubes have been developed.

ELECTRICAL

The sensitivity of a phototube is generally expressed in microamperes per lumen. In choosing the light source for phototube application, not only the amount of light flux but also the color temperature of light should be considered, as the sensitivity of phototubes also depends upon the color of light source.

In order to reduce fatigue, phototubes should always be exposed to as little illumination as possible. The largest feasible cathode area shall always be used to reduce the specific illumination without loss of output. If the following ratings at nominal operating voltage are not exceeded, the loss of original sensitivity will be less than 50% after 500 hours of continuous service.

Spectral Response	Type	Max. Illumination Footcandles	Max. Avg. Current $\mu\text{A}/\text{in}^2$	Max. Peak Current $\mu\text{A}/\text{in}^2$
S1	Vacuum	30	10	100
S1	Gas	20	15	100
S4	Vacuum	30	10	100
S4	Gas	8.5	5	100

At voltages 20 volts below the nominal operating voltage, the values of lines 2 and 4 can be safely doubled.

To guard against stray electrostatic fields, shielding of leads from phototube to the amplifier or relay tube is recommended. If accurate frequency response is to be considered, make the leads as short as practical to minimize capacitance shunting of the phototube load.

Since phototube circuits generally deal with very minute amounts of current, the leakage current should be made small, especially in relay or measurement circuits where feeble illumination is used. Leakage current can vary erratically and may even suppress the effect of the photoelectric current. The leakage can be greatly reduced by the use of tubes having an anode or cathode cap, such as types CE-11V and 31V.

GENERAL CHARACTERISTICS AND ADVANTAGES OF CBS PHOTOTUBES

CBS phototubes are manufactured of the finest materials available, with meticulous care, and to extremely rigid standards. As a result, CBS phototubes have a number of outstanding features, and an unusual combination of high efficiency and long life.

Greater Current Output — Red sensitive tubes have a high output in the infrared region and a particularly low dark current. The cathodes show no tendency to peel or blister.

Wide Frequency Response — Uniform frequency response is a highly important factor in sound production. The CBS phototubes have an almost linear frequency response over a very wide range of frequency.

Non-Microphonic — The CBS phototubes have extremely low microphonic noises.

Low Dark Current — The CBS S1 phototubes have an average dark current of less than 10^{-10} amperes, the lowest in the industry. This effect is so pronounced in CBS phototubes that when working with very small amounts of light, right down to the noise level of a system, better results are often obtained than with multiplier types of tubes, which have always been reputed to be best when dealing with very low light levels.

Testing — All CBS phototubes, S1 and S4 response unless otherwise specified, are tested with a light source of 2870°K color temperature and an illumination of 0.1 lumen on a 0.2 square inch opening directly in front of the tubes. The various tubes are rated as to sensitivity using the testing voltages indicated in the chart. Dark current tests are made using the same testing voltage. Ionization tests are special where specified.

PHOTOTUBE REPLACEMENT DIRECTORY

TYPE NUMBER CHART					SOUND PROJECTOR CHART								
Other Type	CBS Type	Other Type	CBS Type	Other Type	16mm SOUND PROJECTORS		35mm SOUND PROJECTORS						
					MANUFACTURER	SOUND PROJECTOR MODEL	CBS PHOTOTUBE	MANUFACTURER	SOUND PROJECTOR MODEL	CBS PHOTOTUBE			
1P23	CE-1	G17	CE-22	R60A	Natco (Helene Curtis)	3015 & 3030	CE-25-C	Ballantyne	1941-45 Royal Sound Master 1938-41 Duo Sound Master 1937-38 Largen Super 1932-38 Largen Standard	CE-4-WB-C* CE-4-WB-C* CE-4-WB-C* CE-2-C			
1P30	CE-2	V17	CE-22V	R61A									
1P31	CE-3	G19	CE-26	R61AV									
1P32	CE-25	G20	CE-23	R61B									
1P33	CE-26	G22	CE-36	R61BV									
1P35	CE-5	P122	CE-1V	71A	Revere	SP16	CE-2	DeVry	E.S.F. (1000'-2000') 1, 1948, ALB-ASB, & X-Nora XD, XDC, 1200, 10 & 2812	CE-2-C CE-25-C			
1P36	CE-4	G23	CE-1	71AV			CE-2V						
1P37	CE-91	P123	CE-1	R71A			CE-2						
GL-1P37	CE-91	V23	CE-1V	R71AV			CE-2V						
1P39	CE-29	R50A	CE-22	R71TAV			CE-13V						
1P40	CE-30	R50AV	CE-22V	R78A	Universal Camera	J H	CE-26	International Simplex	All Models Made Prior to 1954	CE-1-C			
1P41	CE-22	51A	CE-25	79A			CE-3			CE-4-C			
3A	CE-3	R51A	CE-25	R79A			CE-3						
G4	CE-5	R51AV	CE-25V	GL-441			CE-61			CE-36-C			
G5	CE-4	R51B	CE-64	WL-734			CE-1V			CE-5-WB-C*			
V5	CE-4V	R51BV	CE-34	868	Weber	16mm Syncro-film	CE-4-SR-C	Motiograph	HU & H MK K SH-7500	CE-1-C CE-2-C CE-25-C CE-26-C			
6A	CE-26	53AWB	CE-5	917	Ampro	All Models Made Prior to 1954	CE-25-C			R. C. A.	MI 9060 thru 9067 MI 1060 thru 1067 MI 1070 thru 1077 MI 9070 thru 9077 MI 9040 thru 9047 MI 9005 All other models	CE-21-C CE-21-C CE-21-C CE-21-C CE-21-C CE-25-C CE-1-C	
G6	CE-2	58A	CE-4	WL-919									
V6	CE-2V	58AV	CE-4V	920	Apollo	P-76	CE-A702-PG441						
8A	CE-1	58AVWB	CE-4V	923	Bell & Howell	179H & 179K All other models	CE-30-C CE-1-C						
G9	CE-1	58AWB	CE-4	927									
V9	CE-1V	R58A	CE-4	929	DeVry	RS, 16, Q12, QR12, RR, Q, & SS 11000 & 14000	CE-4-C CE-25-C	S. O. S. Cinematophone	WEB, LER, A, STD, AR, R 35mm Portable BAL & GYB AB GYG	CE-2-C CE-4-RC CE-4-WBC* CE-25-C CE-36-C			
G10	CE-3	R58AV	CE-4V	930									
G12	CE-4	59A	CE-1	934									
V12	CE-4V	59AV	CE-1V	5581			Eastman Kodak			Sound Kodascope	CE-56-A/B		
							Forway			10A, 10B, & 12	CE-25-C		
G14T	CE-21	R59A	CE-1	5583	Holmes	10, 12, 15, 16, 17, 18	CE-25-C	Weber	J. C. & D A. & ABH DR, N, R, SP	CE-2-C CE-4-WBC* CE-4-RC			
G15F	CE-25	R59AV	CE-1V	5653			CE-29						
V15F	CE-25V	R59TAV	CE-11V	6953			CE-A30						
G16B	CE-25	R59B	CE-91										
V16B	CE-25V	R59BV	CE-61				Movie Mite			All models serial numbers over 12509	CE-30-C	Wenzel	WSH3

*WB INDICATES WITHOUT BASE

**FORMERLY CE-1-SC

Table P1 CBS PHOTOTUBES

DESCRIPTION			CONSTRUCTION			SPECTRAL CHARAC.		CHARACTERISTICS				BASIC TYPE *																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
BASIC TYPE *	Gas or Vacuum	Features and Use	Basing			Base			Response Curve			λ at Max. Angstroms			Anode Supply D-C or Peak A-C Volts		Usable Cathode Area Square Inches		Testing Voltage		Dark Current (μa) at Test Voltage		Complete Type		SENSITIVITY RANGE†		Max. μa/Lumen	Gas Amp. Factor, Max.	BASIC TYPE *																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

CE-B25	G		2F	Pee Wee 3-Pin	11	S1	8000	90	0.34	90	0.1	CE-B25-A/B CE-B25-C CE-B25-D	175 90 50	10	CE-B25
CE-26*	G	Sound reproduction	2G	Medium 4-Pin	12	S1	8000	95	1.2	95	0.1	CE-26-A/B CE-26-C CE-26-D	166 104 62	10	CE-26 *
CE-A26*	G	Has short anode	2G	Medium 4-Pin	12	S1	8000	250	0.51	95	0.1	CE-A26	104	10	CE-A26*
CE-29	V		3J	Octal	13	S4	4000	250	0.51	250	0.1	CE-29-Q CE-29-R	55 25	—	CE-29
CE-30	G	Sound and relay control	3J	Octal	13	S1	8000	90	0.51	90	0.1	CE-30-A/B CE-30-C CE-30-D	200 125 75	10	CE-30
CE-A30	G	Shadowless anode	3J	Octal	13	S1	8000	90	0.51	90	0.1	CE-A30	125	10	CE-A30
CE-30V	V		3J	Octal	13	S1	8000	500	0.51	250	0.1	CE-30V-A/B CE-30V-C CE-30V-D	30 22 12	—	CE-30V
CE-31V	V	Light measurement	1B	Small 4-pin	5	S1	8000	500	0.95	250	0.1	CE-31V-A/B CE-31V-C CE-31V-D	30 22 12	—	CE-31V
CE-34	V		2F	Pee Wee 3-Pin	11	S4	4000	250	0.34	250	0.1	CE-34-Q CE-34-R	36 15	—	CE-34
CE-36	G	Sound reproduction	2F	Pee Wee 3-Pin	11	S1	8000	90	0.34	90	0.1	CE-36-A/B CE-36-C CE-36-D	175 90 50	10	CE-36
CE-36V	V		2F	Pee Wee 3-Pin Short	11	S1	8000	250	0.34	250	0.1	CE-36-V	16	26	CE-36V
CE-B36	G		2F	Pee Wee 3-Pin Short	11	S1	8000	90	0.34	90	0.1	CE-B36	90	10	CE-B36
SR-50	V		SR50	Industrial 4-Pin	19	S1	8000	500	1.0	90	.02	SR-50	8	30	SR-50
SR-53	V		SR50	Industrial 4-Pin	19	S1	8000	500	1.0	90	.02	SR-53	20	—	SR-53
SK-60	G		SR50	Industrial 4-Pin	19	S1	8000	90	1.0	90	0.1	SK-60	40	150	SK-60
SK-63	G		SR50	Industrial 4-Pin	19	S1	8000	90	1.0	90	0.1	SK-63	85	—	SK-63
CE-52V	V		52V	Medium 5-Pin	2	S1	8000	250	1.2	250	0.1	CE-52V	22	30	CE-52V
CE-59	G		3J	Octal	13	S4	4000	100	0.51	90	0.1	CE-59-R	75	180	CE-59
CE-64	G		2F	Pee Wee 3-Pin	11	S4	4000	100	0.34	90	0.1	CE-64-Q CE-64-R	160 70	5.5	CE-64
CE-75V	V	Bulb and base silicon treated	75V	Small 4-Pin	5	S1	8000	250	0.51	250	0.00005	CE-75V	20	40	CE-75V
CE-77	G	Sensitivity is average taken at top, center and bottom of cathode	4CT	Small 4-Pin	16	S4	4000	90	4.68	90	0.1	CE-77	75	200	CE-77
CE-84	V		2AP	Bayonet	14	S4	4000	250	0.34	250	0.1	CE-84Q CE-84R	36 15	—	CE-84
CE-86-A/B	G		2AP	Bayonet	14	S1	8000	90	0.34	90	0.1	CE-86-A/B CE-86-C CE-86-D	175 90 50	10	CE-86-A/B
CE-91	G	Sound from dye image track with incandescent light	2K	Dwarf 4-Pin	1	S4	4000	100	0.95	90	0.05	CE-91-Q CE-91-R	180 75	5.5	CE-91

Table P1 continued

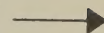


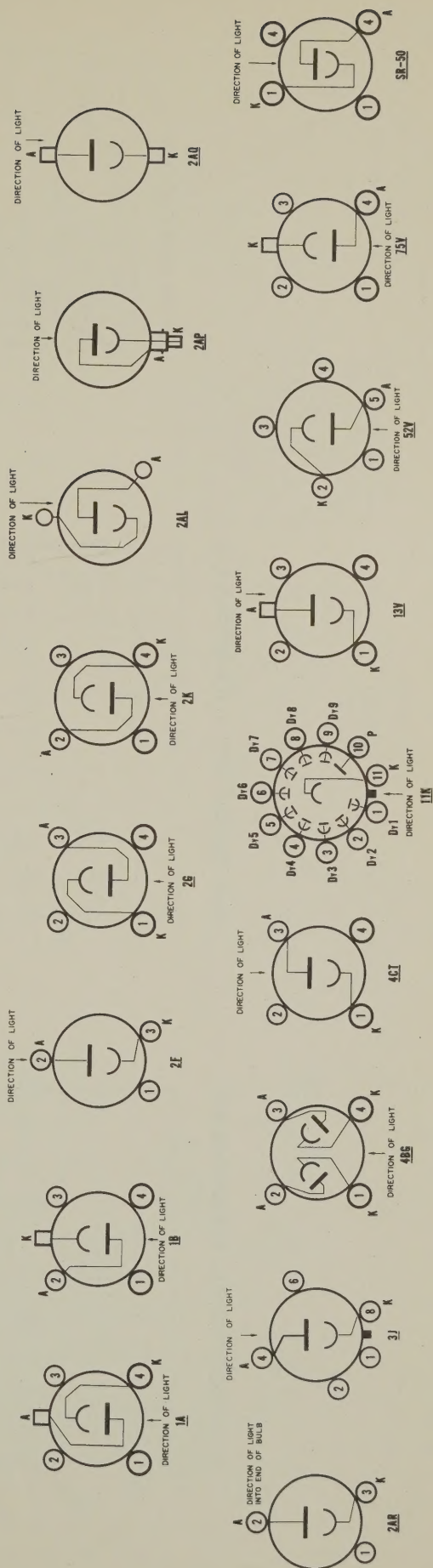
Table P1 Phototubes continued

DESCRIPTION			CONSTRUCTION			SPECTRAL CHARAC.		CHARACTERISTICS			SENSITIVITY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
TYPE	Gas or Vacuum		Features and Use		Basing		Base		Outline Number		Response Curve		λ at Max, Angstroms		Anode Supply D-C or Peak A-C Volts		Average Cathode Current μa		Testing Voltage		Dark Current (μa) at Test Voltage		Radiant μa/lw		Luminous† μa/Lumen			TYPE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	G	V	Sound reproduction	2K	Dwarf 4-pin	1	S1	8000	90	K area = 0.95 in.²	90	0.1	125 min. 250 max.	—	10	1P23	5000 CPS	10,000 CPS	μa/Lumen	0 CPS	5000 CPS	10,000 CPS	Max. Gas Amp. Factor	TYPE	1P23	1P30	1P31	1P32	1P33	1P35	1P36	1P37	1P39	1P40	1P41	868	917	918	919	920	921	922	923	927	929	930	931A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
G	V	Sound reproduction	2K	Dwarf 4-pin	1	S1	8000	90	K area = 0.95 in.²	90	0.1	125 min. 250 max.	—	10	1P23	5000 CPS	10,000 CPS	μa/Lumen	0 CPS	5000 CPS	10,000 CPS	Max. Gas Amp. Factor	TYPE	1P23	1P30	1P31	1P32	1P33	1P35	1P36	1P37	1P39	1P40	1P41	868	917	918	919	920	921	922	923	927	929	930	931A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
G	G	Sound reproduction	2G	Dwarf 4-pin	2	S1	8000	110	K area = 1.2 in.²	90	0.1	95 min. 200 max.	0.01	10	1P30	—	—	—	—	—	—	—	—	1P30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

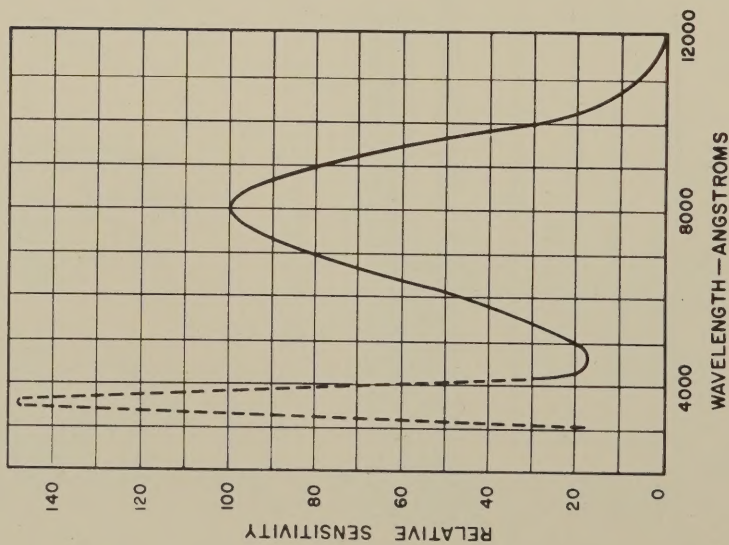
DESCRIPTION			CONSTRUCTION			SPECTRAL CHARAC.	CHARACTERISTICS				SENSITIVITY						
TYPE	Gas or Vacuum	Features and Use	Basing	Base	Outline Number		Response Curve λ at Max, Angstroms	Anode Supply D-C or Peak A-C Volts	Average Cathode Current μa ▲	Testing Voltage	Dark Current (μa) at Test Voltage	Radiant μa/μw	Luminous ‡ μa/Lumen				
						0 CPS							5000 CPS	10,000 CPS	Max. Amp. Factor,	TYPE	
934	V	Sound and facsimile	2F	Pee Wee 3-pin	11	S4	4000	250	4	250	0.005	.028	30	30	30	—	934
5581	G	Sound from dye image track with incandescent light	3J	Octal	13	S4	4000	100	3.0	90	0.05	.135	135	124	108	5.5	5581
5583	G	Sound from dye image track with incandescent light	2F	Pee Wee 3-pin	15	S4	4000	100	2.0	90	0.05	.125	135	124	108	5.5	5583
5653	V	For relay control	3J	Octal	13	S4	4000	250	5.0	250	0.25	.042	45	—	—	—	5653

NOTES:

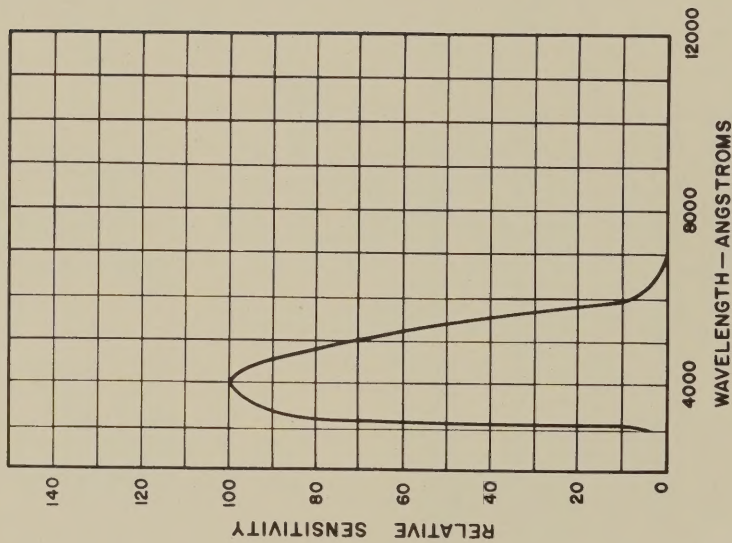
- ★CE types include sensitivity range letter; e.g., CE-1A. Column 13 includes this full type number.
- ▼Averaged over any 30 second interval. Gas types only: at voltages 20 volts below the nominal operating voltage, the average cathode current may be safely doubled.
- †Measured with a 2570°K light source.
- *Measured with a 2500°K light source, .05 lumens/inch², full illumination.
- † Ratio of anode sensitivity to cathode sensitivity.
- With 100 volts per dynode and 90 volts between final dynode and anode.



S-1 SPECTRAL RESPONSE



S-4 SPECTRAL RESPONSE



APPLICATIONS

- Advertising Devices
- Automatic Paint Spraying
- Automatic Pilots
- Burglar Alarms
- Color Determination
- Conveyor Belt Control
- Counting
- Door Annunciator
- Door Openers
- Elevator Controls
- Electronic Organ
- Facsimile Transmission
- Flash Photography
- Grading
- Head Lamp Dimming Control
- Light Control
- Light Measurement
- Measurement Control
- Phonograph Pick-up
- Pin Hole Detection in Metals
- Printing Register
- Punch Press Protection
- Safety Devices
- Sign and Window Light Control
- Smoke Alarm
- Smoke Control
- Sorting
- Sound Reproduction
- Talking Light Beam
- Television Brightness Control
- Temperature Reading and Control
- Traffic Light Control
- Water Level Control

Mechanical Specifications of CBS PHOTOTUBES

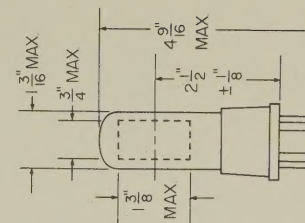
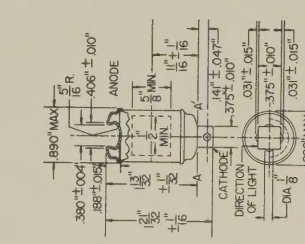
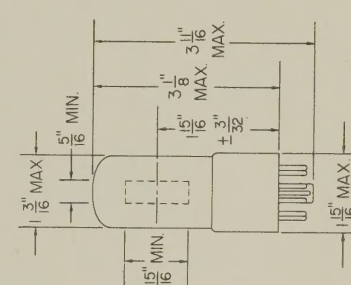
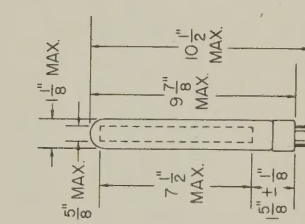
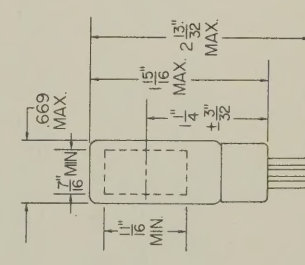
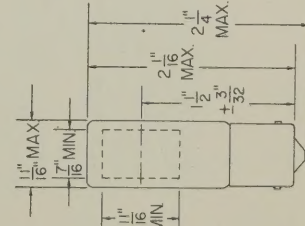
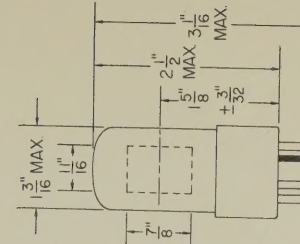
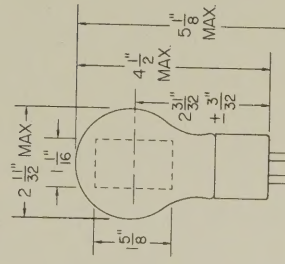
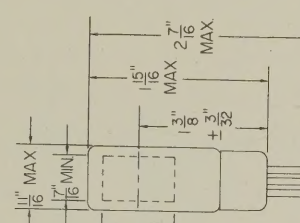
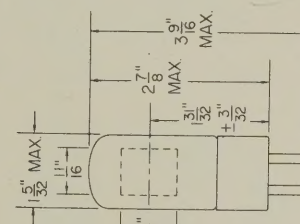
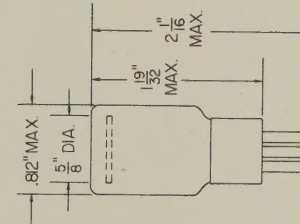
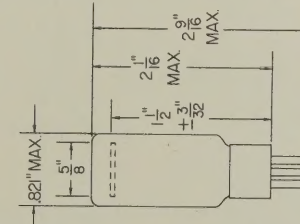
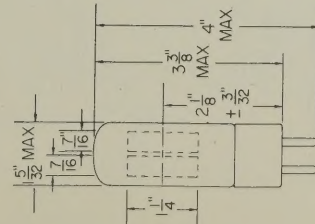
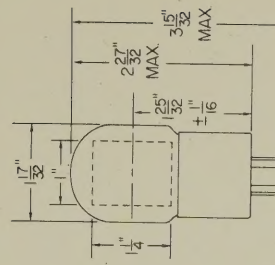
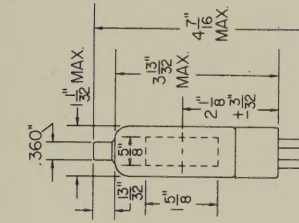
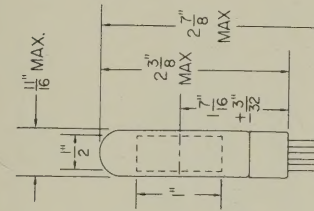
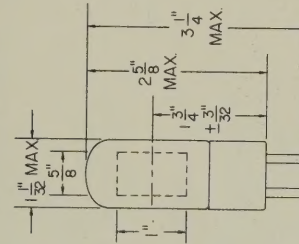
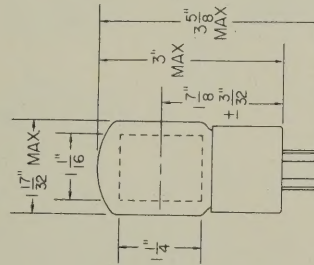
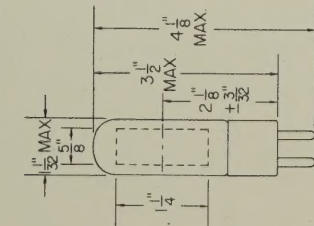


FIGURE 7

Abstract

CONCLUSION

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FIGURE 14

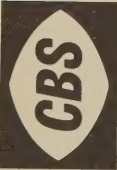
FIGURE 15

FIGURE 16

FIGURE 17

FIGURE 18

950



PHOTOCONDUCTIVE CELLS

CBS photoconductive cells are lead sulfide types with a response primarily in the infra-red region. The thin film of lead sulfide deposited between the two graphite grids has the ability to change its electrical conductance with changes in illumination. In this respect they differ from photoemissive tubes which eject photo electrons from the emissive surface when illuminated.

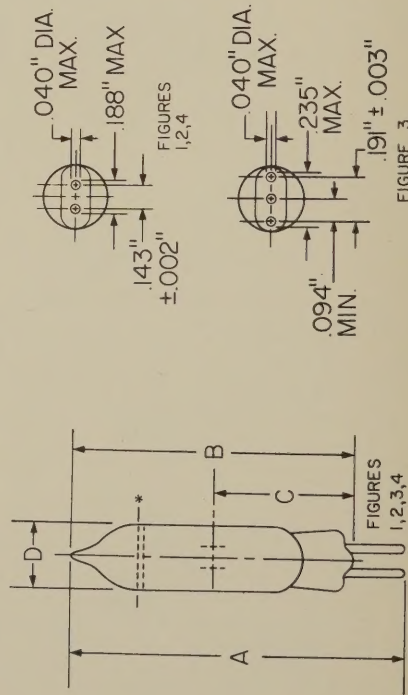
Our lead sulfide cells are evacuated cells, and therefore the problem of sensitivity and resistance changes due to moisture is eliminated.

The cells are of the evaporated type, consisting of a thin film of photoconductive lead sulfide deposited upon an electrically conducting pair of spaced lines called a grid, drawn upon a suitable insulating surface and internally connected electrically to two metal pins brought out through the glass envelope.

To group the cells into logical order, a standard nomenclature was developed which is illustrated in the diagram below. Whenever possible on the order, each cell should be completely specified, for example:

E	Grid Size	Cell Type No.	Sensitivity Class	Dark Resistance Class
706	C	3		

CBS photocells are available in different grid sizes, sensitivities, and resistance ranges. But some ratings are preferred over others for the various types. See the preferred grid type chart to help you select CBS photocells.



Grid preference chart for standard photocells

TYPE†	GRID SIZE	FIGURE NO. (CELL TYPE)	SENSITIVITY CLASS ★	DARK RESISTANCE CLASS ♦
CE-A701C2	1/8" x 1/8"	1	190-630	0.15 meg-0.6 meg
CE-A701C3	1/8" x 1/8"	1	190-630	0.6 meg-2.4 meg
CE-A701D2	1/8" x 1/8"	1	67-190	0.15 meg-0.6 meg
CE-A701D3	1/8" x 1/8"	1	67-190	0.6 meg-2.4 meg
CE-E701C2	1/16" x 1/16"	1	190-630	0.15 meg-0.6 meg
CE-E701C3	1/16" x 1/16"	1	190-630	0.6 meg-2.4 meg
CE-E701D2	1/16" x 1/16"	1	67-190	0.15 meg-0.6 meg
CE-E701D3	1/16" x 1/16"	1	67-190	0.6 meg-2.4 meg
CE-A702C2	1/8" x 1/8"	2	190-630	0.15 meg-0.6 meg
CE-A702C3	1/8" x 1/8"	2	190-630	0.6 meg-2.4 meg
CE-A702D2	1/8" x 1/8"	2	67-190	0.15 meg-0.6 meg
CE-A702D3	1/8" x 1/8"	2	67-190	0.6 meg-2.4 meg
CE-E702C2	1/16" x 1/16"	2	190-630	0.15 meg-0.6 meg
CE-E702C3	1/16" x 1/16"	2	190-630	0.6 meg-2.4 meg
CE-E702D2	1/16" x 1/16"	2	67-190	0.15 meg-0.6 meg
CE-E702D3	1/16" x 1/16"	2	67-190	0.6 meg-2.4 meg
CE-A704C2	1/8" x 1/8"	3	190-630	0.16 meg-0.6 meg
CE-A704C3	1/8" x 1/8"	3	190-630	0.6 meg-2.4 meg
CE-705C3	1/32" x 1/32"	4	190-540	0.6 meg-2.4 meg

†Other sensitivity classes and dark resistance classes than those listed are available upon request. The cells listed include the most common ranges of sensitivity and resistance.

★ Sensitivity Classes:

Sensitivity classes in mv/lc at tungsten color of 2500°K; intensity of 0.114 l/in. ², R_L equals cell resistance, and applied voltage equals 25 volts d-c.

♦ Resistance Classes:

Dark resistance measured with 25 VDC applied to cell.

FIG.	TYPE	A	B	C	D
1	CE-701	1 3/4"	1 1/2"	7/8"	1 3/32"
2	CE-702	1 1/2"	1 1/4"	1 1/16"	5/16"
3	CE-704	1 3/4"	1 1/2"	7/8"	1 3/32"
4¶	CE-705	1 5/16"	2 3/32"	---	.246"

¶ Flat top, light from end

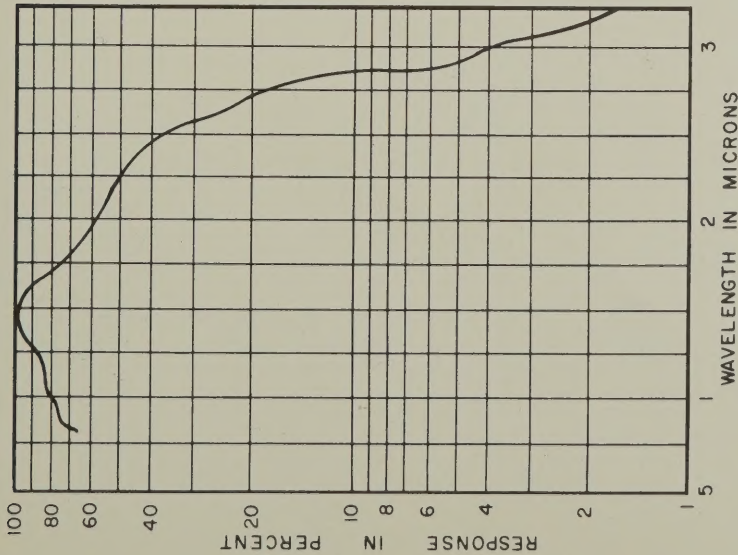


Fig. 1. Relative spectral response of lead sulfide cell

SIGNAL TO NOISE RATIO OF LEAD SULFIDE CELLS

If a constant light flux falls on cells of various areas, the signal is directly proportional to the voltage applied to the cell up to the point where heating effect due to large currents limits the signal. The noise varies inversely with the square root of the area and is also directly proportional with the applied voltage until the thermal noise due to large currents predominates, in which case the noise rises very rapidly. The maximum voltage to be applied to a particular cell can be found by gradually increasing the cell voltage until the signal to noise ratio starts to decrease. If a voltage in the proper range is applied, the signal to noise ratio is inversely proportional to the square root of the area for constant radiant flux. In constant radiant flux density, the signal to noise ratio is directly proportional to the square root of the area, the signal to noise ratio also increases as the color temperature of the source decreases.

The approximate range of signal to noise ratios to be expected and recommended voltages across the cell, for cells of various areas, are given in the table below.

Area	S/N Range in db	Recommended Voltage Across Cell
$\frac{1}{16}'' \times \frac{1}{16}''$	52-72	10.0-22.5V
$\frac{1}{8}'' \times \frac{1}{8}''$	46-66	22.5-45.0V
$\frac{1}{4}'' \times \frac{1}{4}''$	40-60	45.0-90.0V

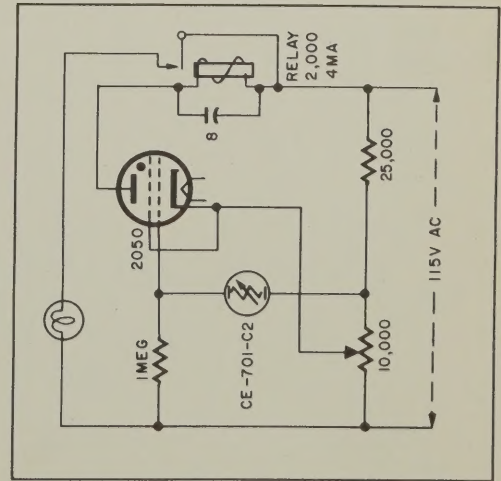


Fig. 2. Thyatron relay operated by an increase in light

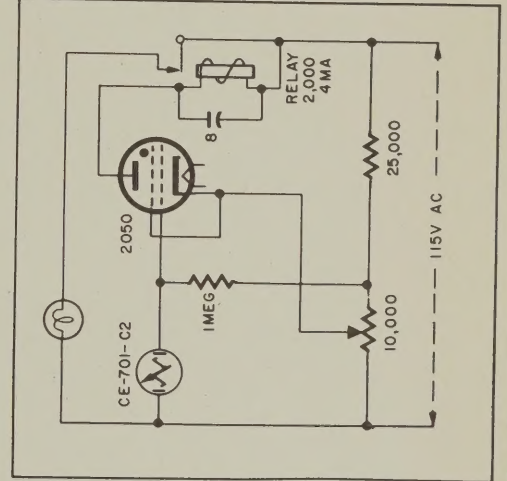


Fig. 3. Thyatron relay operated by a decrease in light

USES AND ADVANTAGES OF LEAD SULFIDE CELLS

The lead sulfide cell has its principal advantage when most of the radiation available from a source with a color temperature of near 3,000°K can be condensed on a cell with a sensitive area of the order of .1 square centimeter ($\frac{1}{8}'' \times \frac{1}{8}''$). If the color temperature of the light source is considerably lower the lead sulfide is much superior to the photoemissive types. In applications where low noise levels are desirable, with no loss in signal voltage, the lead sulfide cell has an advantage over the photoemissive gas tube. In some applications a reduction of up to 20 db in noise level has been gained over that obtainable with a gas tube. Additional advantages are miniature size, nonpolarity of electrodes, linear response with increasing illumination, and non-microphonic operation.

LIST OF APPLICATIONS:

1. Sound reproduction.
2. Infra-red photometry.
3. Burglar alarms, door-openers, etc., especially using infra-red radiation.
4. Tabulating machines.
5. Phonograph pick-ups.
6. Controls and counters.
7. Low temperature pyrometry.
8. Automatic weighing.
9. Automobile headlamp dimming controls.
10. Detection of warm bodies.
11. Oil burner controls.
12. Fire detection.

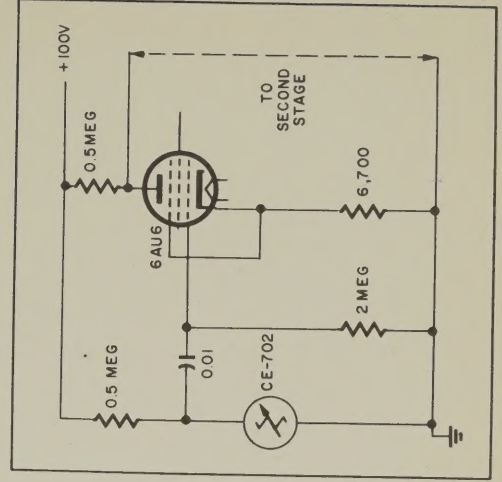


Fig. 4. Input stage for lead sulfide modulated light amplifier



CBS-HYTRON, Danvers, Massachusetts • A Division of Columbia Broadcasting System, Inc.